

# Advanced X-ray Telescope Material System, Phase I Project

SBIR/STTR Programs | Space Technology Mission Directorate (STMD)



## ABSTRACT

Peregrine proposes the combination and use of Be-38Al, electroless nickel plating, and single point diamond turning to create precision x-ray grazing optical surfaces. Large x-ray telescopes will demand large, high stiffness, and lightweight substrates to provide rigidity to support the production of nested optical surfaces while requiring accurate alignment through the use of stable support structures. Ideally, these nested x-ray mirrors would be of heavy metal, microns in thickness and be self-supporting through launch, this is currently impractical. However, near ideal x-ray optics can be produced with the low density material of Be-38Al backing a thin layer of electroless nickel with precision single point diamond turned surfaces. The use of Be-38Al can yield lightweight, precise, and stable substrates. Coefficient of thermal expansion matching electroless nickel can be deposited thinly on top of the Be-38Al substrates, and then single point diamond turned to optical finishes. In addition, Be-38Al is a proven structural material that can be readily fabricated into precision members to create support structures to align and create entire large, athermal x-ray telescopes.

## ANTICIPATED BENEFITS

### To NASA funded missions:

Potential NASA Commercial Applications: The development and verification of the Be-38Al/NiP/SPDT system to yield x-ray optics will enable future NASA large telescopes to be built and launched. Where there may be commercial opportunities, the key focus of this post SBIR activity will be on large next generation NASA x-ray telescopes.

### To the commercial space industry:

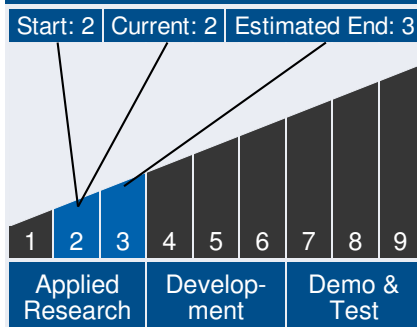
Potential Non-NASA Commercial Applications: Where this technology is focused on x-ray optics and telescopes, it can be beneficial in regards to commercial scanners and x-ray inspection devices. This proposed material system and



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## Technology Maturity



## Management Team

### Program Executives:

- Joseph Grant
- Laguduva Kubendran

### Program Manager:

- Carlos Torrez

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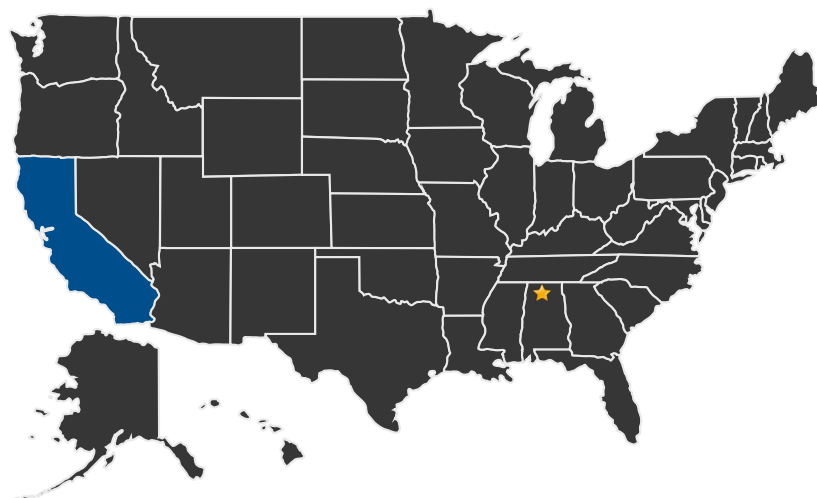
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processing technology can provide the accuracy needed to improve most scanners and optical x-ray systems used for non-destructive examination. This will be of particular interest in the NDE of semiconductors.

## U.S. WORK LOCATIONS AND KEY PARTNERS



■ U.S. States  
With Work

★ **Lead Center:**  
Marshall Space Flight Center

### Other Organizations Performing Work:

- The Peregrine Falcon Corporation (Pleasanton, CA)

## PROJECT LIBRARY

### Presentations

- Briefing Chart
  - (<http://techport.nasa.gov:80/file/23184>)

### Management Team *(cont.)*

#### Principal Investigator:

- Robert Hardesty

### Technology Areas

#### Primary Technology Area:

Science Instruments,  
Observatories, and Sensor  
Systems (TA 8)

└ Observatories (TA 8.2)

└ Mirror Systems (TA 8.2.1)

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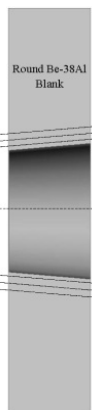
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## IMAGE GALLERY

X-Ray Optics for Large Telescopes  
Concept Illustration

- 1) Cut/Turn ID on precision lathe
- 2) Stress Relieve ID surface using the blank itself to support the precision surface
- 3) Nickel Plate turned surface with matching CTE deposition
- 4) Single Point Diamond Turn Nickel plated surface to X-Ray grating requirement
- 5) Remove the SPDT Optical Surface with thin Be-38Al residual support via stress free wire EDMing
- 6) Repeat Steps 1 through 5 above for additional nested x-ray optics



Contouring / Milled Critical Wire

EDM Cut lines to drop out mirrors

Cutting Tools, Cut ID surface

and SPDT after stress relief

and NiP deposition

Lathe / Turning / SPDT

*Advanced X-ray Telescope Material System, Phase I*

## DETAILS FOR TECHNOLOGY 1

### Technology Title

Advanced X-ray Telescope Material System, Phase I

### Potential Applications

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